the 24th, 9:50 a. m. and 2 p. m., for Arkansas, Oklahoma, Texas except the immediate coast, and northwestern Louisiana; at 9:30 p. m., for Arkansas, Louisiana except southeastern portion, and for the eastern and southern portions of eastern Texas; on the 25th, 10:45 a. m., for the Texan coast and Louisiana except northwestern portion. A decided fall in temperature occurred but the high-pressure area did not follow the anticipated course toward the southeast and verifying temperatures were recorded at only a few stations.

Intense weather conditions were shown on the 8 a. m. weather map of December 27, and their progress southeastward over the district, with exceptionally severe weather, was forecast.

The cold wave, of unusual severity for December, moved southward, breaking records of long standing in some localities. It brought temperatures of about 0° F. or below in the Texas Panhandle and Oklahoma; 10° to 14° in northern Texas; and 20° to 26° in the southern portion; 0° to 8° in northern and 8° to 12° in southern Arkansas; 10° to 14° in northern and 12° to 19° in southeru Louisiana. At New Orleans the minimum temperatnre was 19°, the lowest of record at this station.

The warnings and advices relative to protective measures which should be taken were generally followed and much loss to vegetation and live stock prevented. Although the harvesting of matured crops was pushed, the loss of vegetables in the fields, for which no protection was provided, exceeds $1,000,000. Only about half of the people heeded the warning to drain their water pipes, and the pipes in more than 3,000 residences were burst by by the freeze.

Storm warnings issued on December 7 were verified. No general storm occurred without warning.

Fire-weather warnings were issued on the 7th, 18th, and 24th and were justified.—*I. M. Cline, District Forecaster.*

Denver, Colo., forecast district.—December, 1917, was unusually dry and mild in this district, due to a succession of cyclonic areas which passed eastward along the northern storm tracks. At Modena on the 19th and at Phoenix and Modena on the 29th higher temperatures were reported than ever previously recorded at those stations so late in December. The district was notably free from storms. No cold waves occurred, except on the eastern slope, where there were rapid alternations of temperature, especially in eastern Colorado from the 7th to the 14th, and in the early part of the third decade when the weather was under the influence of anticyclones that moved southward from Alberta.

Cold-wave warnings were issued for portions of eastern Colorado on the 7th, 8th, 9th, 11th, 12th, 13th, 23d, and 24th, and for eastern New Mexico on the 7th, 9th, and 12th. The warnings were generally fully verified, except for eastern Colorado for the 24th and 25th. However, temperatures were 20° to 30° lower in eastern Colorado on the 24th and were close to 0° in portions of eastern Colorado on the 25th. Frost warnings were issued for south-central Arizona on several days during the fore part of the month, and frosts were frequent in that portion of the State, with a killing frost near Yuma on the 8th.—*Frederick W. Brist, Assistant Forecaster.*

San Francisco, Cal., forecast district.—Storms moved eastward from the North Pacific with great regularity during December, 1917; but with the exception of the storm of the 25th, which passed inland along the Canadian boundary, their passage was through northern British Columbia. The storm movement at so high a latitude at this season of the year gave almost continual rain or snow in Washington and more than the usual number of days with precipitation in Oregon and Idaho, and very light precipitation in California and Nevada. In fact, drought conditions prevail in the two latter States.

Storm warnings were issued along the Washington and Oregon coasts on the 15th, 16th, 21st, 23d, 25th, 28th, and 31st, and along the California coast from Point Reyes northward on the 25th. In most cases they were verified, and it is believed that they were justified in every instance

Areas of high pressure prevailed almost continually over the central and southern plateau region causing severe frosts almost daily during the first half of the month in California. While the temperature in the citrus belts fell below freezing on many nights, it did not reach a sufficiently low point to do any material damage.

Unusually high temperatures occurred in Idaho and Nevada on the 19th, and in portions of Washington, Oregon and Idaho on the 29th, when previous records for December were equalled or exceeded. The warm weather on the 29th caused a rapid melting of the snow in the mountains in western Washington, resulting in high rivers and some damage from floods.

This is probably the driest season in California since records have been kept, and there is less snow in the mountains than ever before known at this time of the year. Only isolated peaks are snow covered and the great area above 5,000 feet, at this season usually covered with several feet of snow, is now bare.—*G. H. Willson, District Forecaster.*

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HURRICANES OF 1917.

By CHARLES A. DONNEL, Meteorologist.

[Dated: Weather Bureau, Washington, D. C., Feb. 3, 1918.]

Fewer storms than usual, of tropical origin, occurred during the year 1917. In fact only one disturbance that could be classed as a hurricane of the first magnitude viz, September 22–30, came within the field of our observations. However, it has seemed proper to include four storms in the present category, and their paths have been traced on Chart X (XLV—121) of this issue of the MONTHLY WEATHER REVIEW.

Storm of August 9.—Information concerning this storm is extremely meager. What at the time was believed to be a secondary center of a barometric depression moving eastward near the mouth of the St. Lawrence River appeared off the North Carolina coast. Later advices seem to disclose that this storm was of tropical origin, having formed east of the Virgin Islands and passing thence northwestward to the position charted on August 9.

Storm of September 4.—On September 4 a storm appeared south of the Bermuda Islands as shown by the weather report from Hamilton. The pressure was 29.46 inches with a wind of gale force and rain. The center of the disturbance passed to the eastward and northward of the islands some time between 12 o'clock noon and 4 p. m. the same date. No further facts in reference to this storm have been received.

Storm of September 13–18.—The second tropical storm of September made its first appearance as a definite disturbance on the morning of September 13 over eastern Cuba. During the following 24 hours the center moved northward to a position off the eastern coast of Florida. From that point the storm advanced northeastward and by the night of September 17–18 was off Cape Cod. It continued its northeastward movement and passed beyond Newfoundland on September 20.

Storm of September 22–30.—This storm may be classed as a hurricane of the first magnitude. It first showed true cyclonic characteristics on September 22 south of Haiti, advancing thence in a general west-northwesterly direction to a position off the mouth of the Mississippi River whence it recurved sharply to the northeastward and entered the United States near Pensacola, Fla. Dissolution began soon after the storm struck the land and by the morning of September 30 the remnants had disappeared over southeastern Georgia. Articles descriptive of this hurricane appear in the REVIEWS for September and October, 1917. The few additional facts that have come to hand since the articles referred to were prepared, serve to furnish evidence as to the hurricane's great intensity throughout virtually its entire existence. The center of the track crossed Jamaica and great destruction was caused on that island, the banana industry having been almost wiped out. Mr. O. L. Fassig, Meteorologist, U. S. Weather Bureau, who visited the Isle of Pines shortly after the passage of the hurricane there, states that the town of Nueva Gerona was devasted, many of the staunchest structures in the town having been leveled. Three apparently reliable barometer readings at that point indicated a minimum of 27.70 inches about 1 p. m. of September 25. In the Pinar region of western Cuba orchards and other crops were ruined. It is thought that a special report by Mr. Fassig on this storm will be prepared later on.